The Sidereal Messenger.

CONDUCTED BY WM. W. PAYNE,

Director of Carleton College Observatory.

JUNE, 1887.

CONTENTS:

Thou Lord in the beginning hast laid the foundation of the earth, and the heavens are the works of thy hands.

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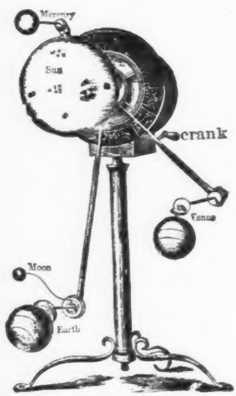

HELIOTELLUS.

When the Earth's axis is pointed to the north, it will continue so pointing throughout the revolution, and will be in the Ecliptic. The Earth rolls over from west to east, and if the Equator be continued to the sky, it will meet the Equinoctial. So with the Ecliptic, if continued, it will come near to the Moon, near to Mercury, near to Venus, and always to the Sun, for the ecliptic plane.

I have now in my possession all the Heliotelluses for sale, made with a set of tools costing $25,000, which tools were afterwards destroyed by fire. They were so accurately made that the Heliotellus cannot now be duplicated for less than $250 each. The greatest impediment I find in their introduction is the Tellurian, which makes a false showing of the heavenly movements. It is a device in which the Earth's axis wabbles around the zenith and never points to the north. This is the greatest bearier to the comprehension of this most sublime of the sciences. The Heliotellus shows so near the truth that it is not hard to comprehend.

In high schools, seminaries, colleges, and all places of learning we find many globes and maps of the earth, but where can one be found having the Equator of the Earth so constructed that if continued it will meet the Equinoctial in the right place on the sky? Every child should have a truthful understanding of science. The Ecliptic should be correctly understood. All instruments which show imperfect teaching are hurtful; those which teach correctly are useful. The one should be rejected, the other sought for, and when found should be prized even as a "pearl of great price." Three hundred such I now possess, all perfectly made, and I now propose to sell two hundred at the reduced price of $20 each, or for $65, the price of one, I will send four, each well packed in a strong box to carry by express anywhere. Address,

HENRY WHITALL,

BELVIDERE SEMINARY, BELVIDERE, N. J.

The Sidereal Messenger,

CONDUCTED BY WM. W. PAYNE,

Director of Carleton College Observatory, Northfield, Minnesota.

VOL. 6, NO. 6. JUNE, 1887. WHOLE NO. 56.

COMETS OF THE YEAR 1886.*

Comet 1885, V. Cf. V. J. S. 21, p. 21. The last observation was made, as subsequently became known, by Pechüle in Copenhagen, March 1, 1886.

The following observations have been published since the last report :†

Brussels 115. 291.
Copenhagen 115. 387.
Lyons B. A. 3. 135.
Marseilles B. A. 3. 167.
Nashville 115. 323.
Padua 116. 107.
Pola 114. 211.
Rome 114. 205.
Vienna 114. 347.

Comet 1886, I. (Fabry). Cf. V. J. S. 21, p. 21. During the first days of April, the comet was visible to the naked eye. In the telescope, its nucleus could be seen surrounded by a brilliant coma, to which was appended a nearly straight slender tail over 1° in length; toward the end of the month, the comet reached the brightness of a star between the 2nd and 3d magnitudes with a length of tail from 4° to 5°; yet, because of the low position of the comet in the twilight, its appearance could not be called especially conspicuous. Photometric measurements of brightness by G. Müller show that at least during the time from the beginning of March to the end of April the nucleus of the comet gave out almost solely reflected sunlight, and that the light of its own emitted by it really

* Extracts from the *Astronomischen Gesellschaft*, Vol. 22, No. I. Translated from the German by Miss Mary B. Cutler, Senior Class Carleton College, Northfield, Minn.

† The following periodicals are compared: *Astronomische Nachrichten* (without further designation) to Vol. 116, p. 256; *Monthly Notices* (M. N.) to Vol. 47, p. 120; *Comptes Rendus* (C. R.) to Vol. 104, p. 614; *Bulletin Astronomique* (B. A.) to Vol. 4, p. 48; *Astronomical Journal* (A. J.) to Vol. 7, p. 64.

furnished but a very small contribution to the total light. The Potsdam spectroscopic observations come to similar conclusions, according to which the spectrum of the bands in comparison to the continuous spectrum was rather faint, while in contradiction of this, Trèpied in Algiers expressly emphasizes a strong prominence of the bands in the spectrum. The observations on the northern hemisphere closed with April 25 at Vienna and Copenhagen; in the southern hemisphere the comet appeared first on May 1st as a striking object to the naked eye with a perfectly straight, sharply defined tail, 9° long. It was still visible to the naked eye with diminishing brightness until the middle of May; with a telescope it could be followed until July 30, on which day Finlay at the Cape last observed it. The following elements by A. Svedstrup are derived from six mean positions of 1885 from Dec. 3, 1886, to March 22, and will probably not differ very much from the final results:

$$T = 1886 \text{ Apr. } 5.99962 \text{ Berlin M. T.}$$

$$\left.\begin{array}{rl} \pi = & 162^\circ\ 58'\ \ 5.3'' \\ \Omega = & 36\ \ 22\ \ 38.7 \\ i = & 82\ \ 37\ \ 17.1 \end{array}\right\} 1886.0$$

$$\log q = 9.807767$$

To the observations quoted from the V. J. S. 21, p. 22, may be added the following:

Algiers C. R. 102. 731; B. A. 3. 234.
Bothkamp 114. 171.
Brussels 115. 291.
Cape 114. 235.
Christiania 114. 379.
Copenhagen 115. 385.
Cordova 116. 59.
Dresden 114. 205.
Glasgow, Mo. 115. 107.
Gothe 115. 139.
Greenwich M. N. 46. 303, 348, 399.
Kremsmuenster 115. 391.
Leipzig 115. 235.
Lyons B. A. 3. 134, 236.
Marseilles B. A. 3. 166.
Melbourne 116. 145.
Munich 114. 315.
Nashville 115. 323.
Nice B. A. 3. 277.
Orwell Park 115. 289.
Padua 116. 107.
Paris B. A. 3. 450, 493.
Plonsk 114. 395.
Pola 114. 211.
Prague 116. 57.
Rome 115. 329.
Scarborough M. N. 47. 28.
Sidney M. N. 46. 495.
Taschkent 114. 235.
Turin 115. 331.
Vienna 114. 347.
Washington 115. 109.
Windsor 115. 393.
At Sea M. N. 46. 457, 498; M. N. 47. 117.

Comet 1886 II. (Barnard). Cf. V. J. S. 21, p. 22. The comet became visible to the naked eye with increasing brilliancy toward the 1st of May and could be observed for 14 days in the northern hemisphere as a round bright nebula with distinct but wasted nucleus and a tail 3° long. On the 12th of May, already situated low in the horizon, it reached the brightness of a star of the 3d magnitude, without, however, presenting a striking appearance. Also, G. Müller in connection with spectroscopic observations was able to observe in it a striking falling off of its own light, in comparison with the sunlight reflected. In the northern hemisphere it was observed last by Pechüle in Copenhagen on the 15th of May; in the southern hemisphere the observations began on the 29th of May, after the comet had already passed the maximum of brightness, and closed with the Cape observation of the 26th of July.

We have not at present better parabolic elements than those given in the V. J. S. 21, p. 23. Two more orbit computations from three observations by Thraen (A. N. 115. 79) and Morrison (SID. MESS. 5. 118) have indicated a hyperbola; but these can, as the computers themselves perceive, merit no confidence so long as the impossibility of representing the observations by a parabola is not proved.

The following observations are added to those quoted in the V. J. S. 21, p. 23:

Algiers C. R. 102. 731; B. A. 3. 234, 496.
Brussels 115. 291.
Christiania 114. 379.
Copenhagen 115. 387.
Cordova 116. 61.
Dresden 114. 205, 379.
Glasgow, Mo. 115. 107.
Gotha 115. 141.
Greenwich M. N. 46. 303, 348, 399.
Kiel 115. 107.
Kremsmuenster 115. 391.
Leipzig 115. 235.
Marseilles B. A. 3. 167.
Melbourne 116. 147.
Munich 115. 47.
Nashville 115. 323.
Nice B. A. 3. 275.
Orwell Park 115. 289.
Padua 116. 107.
Paris B. A. 3. 584.
Plosnk 114. 395.
Pola 114. 211; 116. 193.
Prague 116. 57.
Rome 115. 329.
Scarborough M. N. 47. 28.
Sydney M. N. 46. 497.
Taschkent 114. 235; 115. 109.
Turin 115. 331.
Vienna 114. 347.
Virginia Univ. 115. 43.
Washington 115. 109.
Windsor 116. 123.
At Sea M. N. 47. 117.

Comet 1886, III. (Brooks 2); discovered in the morning sky by Brooks at Phelps, April 30. The comet presented in the telescope the exact image of a great comet. According to Pechüle there followed the extremely small nucleus a straight nebulous tail some 12″ broad, ending in a second somewhat wasted nucleus from which the tail, 10′ long, curved, fan-shaped towards the south. B. von Engelhardt mentions, besides, a faint off-shoot 6′ in length that split off by a single cleft from the main tail and bent toward the south.

When the comet was looked for again, after the full moon on May 20th, its appearance had entirely changed. Instead of the bright comet, Knorre saw only a light vapor from 5′ to 10′ in length. Tempel describes it during these days as a fusiform nebula 12′ in length and 1½′ in breadth, without head or bright nebulous spot in the place of it; a measurement of this headless mass seemed to him impossible. The last observation is that of Celoria in Milan, May 24; on June 3d it was, to be sure, still visible, but no longer to be observed.

The following elements by Celoria extend over the whole time of visibility, and will surely come very near to the final results:

$$T = 1886 \text{ May } 4.482162 \text{ Berlin M. T.}$$

$$\left.\begin{aligned} \pi &= 326^\circ \; 19' \; 6.5'' \\ \Omega &= 287 \;\; 45 \;\; 33.4 \\ i &= 100 \;\; 12 \;\; 6.7 \end{aligned}\right\} 1886.0$$

$$\log q = 9.925294$$

Observations:

Algiers C. R. 102. 1096; B. A. 3. 496.
Berlin 114. 317, 331.
Brussels 115. 295.
Copenhagen 115. 387.
Dresden 114. 288, 317, 379.
Hamburg 114. 301.
Kiel 114. 237, 317.
Leipzig 115. 237.
Lyons C. R. 102. 1052.
Marseilles B. A. 3. 276.
Nice C. R. 102. 1149; B. A. 3. 277.
Paris C. R. 102. 1051.
Rome 114. 301; 115. 329.
Washington 115. 109.

Comet 1886 IV. (Brooks 3) was found by Brooks on May 22nd as a faint nebula with a diameter of 2′. Unfortunately the extreme faintness of the comet's light did not permit its being followed longer than until July 3, which is the more to be re-

gretted, as this seemed to belong to the interesting class of comets with short periods of revolution.

The following elements by Hind are based on three observations, May 25, June 3, and July 1, and show the last observations at Nice, of July 3, to be without certainty:

$$\begin{aligned} T &= 1886 \text{ June } 6.60866 \text{ Berlin M. T.} \\ \pi &= 229^\circ\ 45'\ 58.0'' \\ \Omega &= 53\ \ \ 3\ \ 25.7 \\ i &= 12\ \ 56\ \ \ 1.8 \\ \varphi &= 37\ \ 27\ \ 10.2 \end{aligned} \Bigg\} 1886.0$$

$$\begin{aligned} \log a &= 0.5329478 \\ \mu &= 563.0992'' \\ U &= 6.301 \text{ years.} \end{aligned}$$

A second elliptical orbit by S. Oppenheim during the same interval gives a period of revolution of 9.05 years, but appears not to represent the observations quite so well as the orbit of Hind.

Observations:

Albany 114. 365.
Algiers 114. 403; C. R. 102. 1438; B. A. 3. 496.
Arcetri 114. 365; C. R. 115. 47.
Lyons 114. 365; C. R. 102. 1303.
Melbourne 116. 147.
Nashville 115. 323.
Nice 115. 47; C. R. 102. 1230; 103. 119; B. A. 3. 278, 535.
Pola 116. 193.
Rome 114. 365.
Strasburg 114, 365.
Sydney M. N. 46. 497.
Vienna 114. 365, 399.

Comet 1886 V. (Brooks 1) discovered by Brooks before the two preceding ones on the evening of April 27 as a moderately bright round mass of light 2′ in diameter with an eccentric condensation. The comet, its brightness increasing, could be followed in the northern hemisphere until the end of May. The observation of position ended at Milan with May 25, at Vienna with May 28. The observations in the southern hemisphere began after the maximum of brightness was past on the 3d of July and closed with the Cape observation of July 30.

The following elements by A. Krueger are based on three observations, April 29, May 9 and 21, and appear, from the numerous provisory elements existing, to represent the observations best:

$$
\begin{aligned}
T &= 1886 \text{ June } 7.42622 \text{ Berlin M. T.} \\
\pi &= \left.\begin{array}{l} 33^\circ\ 55'\ 26.9'' \\ 192\ \ 42\ \ \ 6.5 \\ \ 87\ \ 44\ \ 23.1 \end{array}\right\} 1886.0 \\
\log q &= 9.431999
\end{aligned}
$$

(with Ω and i on the second and third lines of the bracket)

Observations :

Algiers C. R. 102. 1096. B. A. 3. 495.
Ann Arbor 114. 397.
Arcetri 114. 299, 332.
Berlin 114. 299, 329.
Bruesels 115. 293.
Copenhagen 115. 387.
Dresden 114. 287, 299, 379.
Gotha 115. 141.
Greenwich M. N. 46. 400, 459.
Hamburg 114. 237, 317, 329.
Harrow 114. 299.
Kiel 114. 223, 237, 299, 317, 329.
Leipzig 115. 235.
Lyons C. R. 102. 1052.
Milan 115. 159.
Marseilles B. A. 3. 275.
Munich 114. 381.
Nice C. R. 102. 1149; B. A. 3. 277.
Orwell Park 115. 289.
Padua 116. 107.
Paris C. R. 102. 1008.
Plonsk 114. 395.
Pola 116. 193.
Prague 116. 57.
Rome 114. 237; 115. 329.
Sydney M. N. 46. 497.
Turin 115. 331.
Vienna 114. 299.
Windsor 116. 123.

Winnecke's Comet 1886 VI. For last year's appearance of Winnecke's comet, A. Palisa had, on the basis of the elements derived by Oppolzer from three observations, found the following elements, which, on account of the great disturbances, are only closely approximate :

Epochs and osculation 1886 Aug. 31.26 mean time at Berlin.

$$
\begin{aligned}
T &= 1886 \text{ Sept. } 16.5 \text{ Berlin M. T.} \\
M &= 357^\circ\ 15' \\
\left.\begin{array}{r} \pi \\ \Omega \\ i \end{array}\right. &= \left.\begin{array}{rr} 276 & 4 \\ 101 & 56 \\ 14 & 27 \end{array}\right\} 1890.0 \\
\varphi &= \ 46\ \ 37 \\
\mu &= 610.48'' \\
\log a &= 0.509557
\end{aligned}
$$

On the basis of an ephemeris computed from these elements by E. Lamp, Finlay at the Cape succeeded in finding the comet on the 19th of August as a circular nebulous mass 1′ in diameter and of the brightness of a star of the 10th magnitude.

Towards the middle could be seen a slight condensation without a real nucleus; there was no tail. The passing of perihelion, according to this observation, took place 12 days earlier than was to be expected according to the elements of Palisa. On account of the unfavorable position for the northern hemisphere, it was only at the observatories lying in the South, Palermo, Nice and Algiers, that some few observations of the comet could be taken; so much the more reason is there for gratulation that Finlay himself was able to follow it through several months till Nov. 29. His great range, embracing 32 observation days, will be of great importance in the correction of the orbit.

Observations:

Algiers C. R. 103. 457; B. A. 3. 497.
Cape 115. 111.
Nice 115. 329; C. R. 103. 516; B. A. 3. 535.
Palermo 115. 143.
Rio C. R. 103. 918.
Sydney M. N. 47. 67.

Comet 1886 VII. (Finlay) discovered Sept. 26 by Finlay at the Cape as a round, faint, nebulous mass 1′ in diameter with traces of a central condensation. The very first computation of the orbit showed such a resemblance to the elements of the comet of de Vico 1844 I, which had not been found again up to this time, that the identity of the two heavenly bodies was for a time scarcely doubted. Unfortunately, the later computations of Prof. Krueger and Prof. Boss, although they also indicated an ellipse with a short period of revolution for Finlay's comet, yet make the identity of the two comets at least extremely doubtful. The periodic time of 2433 days shown by the elements of Prof. Krueger given below, is 440 days longer than that found by Brünnow for the comet of de Vico, and it is impossible to conceive how, in the time from 1844 to 1886, such a change of the orbit can have taken place. Consequently the assumption that we have before us two different comets with similar orbits must provisionally be regarded as by far the more probable.

The elements by Prof. Krueger, which are derived from single observations from Sept. 29, 1886, to Feb. 23, 1887, run as follows:

$$
\begin{aligned}
T &= 1886 \text{ Nov. } 22.42429 \text{ Berlin M. T.} \\
\left.\begin{aligned}
\pi &= 7^\circ \; 34' \; 14.6'' \\
\Omega &= 52 \;\; 29 \;\; 58.8 \\
i &= 3 \;\;\; 1 \;\; 39.2
\end{aligned}\right\} & \; 1886.0 \\
\varphi &= 45 \;\; 54 \;\; 22.7 \\
\mu &= 532.6894'' \pm 0.395'' \\
U &= 2432.937 \text{ days.}
\end{aligned}
$$

After the comet had reached its greatest southern declination —26° in the middle of October, it turned toward the north, and soon, on account of the increasing brightness and its favorable position in the evening sky, became the object of eager observation for the astronomers of the northern hemisphere. From the middle of December on, the bright mass was observed to be slowly on the wane, without the observations having to be discontinued up to this time (middle of March).

Observations:

Albany 115. 269; A. J. 7. 21, 52.
Algiers B. A. 3. 586.
Bethlehem, Penn. A. J. 7. 54, 61.
Bordeaux C. R. 103. 1170.
Cape 115. 223.
Dresden 116. 43, 111, 247.
Goettingen 116. 219.
Hamburg 116. 111, 219.
Kiel 116. 13, 77, 111, 127, 219
Kremsmuenster 116. 41.
Lyons C. R. 103. 590.
Marseilles B. A. 3. 533,
Nashville 115. 267.
New York (Searle) A. J. 7. 15, 16.
Nice 115. 239; 116. 151; C. R. 103. 590.
Padua 116. 215.
Palermo 115. 239; 116. 151.
Pola 116. 193.
Rome 115. 237, 253, 267, 283, 303; 116. 27, 43.
Sydney M. N. 47. 68.
Taschkent 116. 247.
Turin 115. 397; 116. 153.
Washington A. J. 7. 8, 31, 62.

Comet 1886 IX. (Barnard-Hartwig)* discovered in the morning sky of Oct. 4 by Barnard in Nashville, on Oct. 5 by Hartwig in Bamberg and by Pechüle in Copenhagen, the last named of whom, meantime, was first able to verify the discovery on the following day. The comet was bright, round, with a distinct condensation of the brightness of a star of the 8th magnitude. With increasing brightness it became visible to the naked eye by the end of October. By the beginning of

* The notations for 1886 VIII. are reserved for the comet discovered by Barnard Jan. 23, 1887.

December, it had developed to a beautiful object with a brilliant nucleus between the 2nd and 3rd magnitudes. On the very day after the discovery, Barnard had been able to perceive traces of a tail; towards the end of the month, this developed more clearly and reached, by the end of November, the considerable length of 5°. A second shorter tail already showed itself by the beginning of November; this, like the main tail, increased in brightness, so that the comet by the beginning of December presented a really characteristic appearance. Barnard reports besides, Nov. 23, still a third tail which, however, on Nov. 28, he was no longer able to perceive.

In the spectrum of the comet, the three usual bands stand out clearly on the continuous spectrum, without any other specially characteristic properties having shown themselves. Of especial interest are the photographs which Gothard in Herény took of the comet. Among them all, the plates of Nov. 27 and 28 are of the greatest beauty; these show the form and structure of the tail with such distinctness that we have a right to expect great disclosures in future from the application of photography to comets for the discernment of the nature of these heavenly bodies.

The following elements are derived by A. Svedstrup from three mean positions, Oct. 8, Oct. 28, and Nov. 18:

$$T = 1886 \text{ Dec. } 16.51908 \text{ Berlin M. T.}$$

$$\left.\begin{aligned} \pi &= 223^\circ\ 43'\ 46.1'' \\ \Omega &= 137\ \ 21\ \ 50.1 \\ i &= 101\ \ 39\ \ 36.0 \end{aligned}\right\} 1886.0$$

$$\log q = 9.821442$$

In the beginning of January, 1887, the comet became invisible to the observers in the northern hemisphere; on Jan 8, so far as is now known, the last observation took place in Dresden. There is still hope, however, that in March and April, 1887, there will be successful observations in the southern hemisphere.

Observations:

Algiers B. A. 3. 586.
Bothkamp 115. 283; 116. 125.
Copenhagen 115. 253.
Dresden 116. 247.
Gotha 115. 317; 116. 171.
Greenwich M. N. 47. 27, 65, 116.
Hamburg 115. 283.
Kiel 115. 283, 317; 116. 125.
Kremsmuenster 116. 43.
Liege 115. 317.
Marseilles B. A. 3. 533.
Padua 116. 215.
Palermo 115. 255; 116. 27.
Pola 116. 193.
Prague 115. 255; 116. 155.
Strasburg 115. 285.
Turin 115. 397; 116. 153.
Vienna 115. 253.
Washington A. J. 7. 8, 31.

The last year's appearance of the periodic comet Tempel 3, which, according to the computations made beforehand by J. Bossert, was to pass its perihelion May 9.5, has, unfortunately, on account of the extreme faintness of the light of the comet and its unfavorable position near the sun, passed by unobserved.

The comet of Olbers (Cf. V. J. S. 21, p. 24) also has not been found the past year.

PRESIDENT HOLDEN'S REPLY TO PROFESSOR PROCTOR.

In the issue of the *Examiner* (Cal.) of March 27th there is an article by Mr. Proctor which refers to me in such terms that I am bound to notice it, and as space has been given to his personal attack upon me, I beg to be allowed the space for reply.

In order to present the basis for a judgment I must give the whole history of our relations, which, fortunately for your readers, are not complex.

In the *Atlantic Monthly* for September, 1874, I wrote a review of two of Mr. Proctor's recent books, from which the following words are taken:—After speaking of his book on "Saturn" I said: "This book was a success, as it deserved to be, and it led its author (as too candid biographers have told us) to attempt to earn a large sum of money by writing similar books. The titles of these books are well known and are an index to the rather sensational character of the books themselves—'The Sun, Ruler, Light, Fire and Life of the Planetary System,' 'Other Suns than Ours,' 'The Orbs Around Us,' 'Other Worlds than Ours,' etc."

To these remarks Mr. Proctor replied in a letter to the editor of the *Atlantic Monthly* (Mr. W. D. Howells), in which he objects to my having included "Other Suns than Ours" in the list of books above given for the reason that although it had been announced three years before it had never been published. This was quite true, as it had not been published as a book, but what I presume to have been its substance had been given in a lecture delivered in New York under the title "Other Suns than Ours," which I had read. As soon as possible it was replied to Mr. Proctor that the mention of the book-*title*, "Other Suns than Ours," even in so incidental a casual way, was "an undoubted slip for which Mr. Proctor has our apology."

In extenuation of the acknowledged inadvertence it was said that from 1868 to 1875 Mr. Proctor had published at least twenty (20) separate volumes, and the public was left to infer the impossibility of even the most devoted critic reading and remembering the particular contents of each of three volumes per year from the same hand on similar subjects, especially as the titles of these seemed to be chosen for sensational and advertising purpose only, and as my criticisms applied to the contents of nearly all of them.

At the time I wrote the first review I truly believed I had read some rather popular but not very valuable writing between the covers of a book—one of Mr. Proctor's twenty—and that the title of the book was "Other Suns than Ours."

I know now that I read the not very valuable writing referred to as a lecture by Mr. Proctor which was reported in the *New York Tribune* under the same title.

I submit that the mistake of confounding a printed lecture with a printed book was, under the circumstances, pardonable. I have moreover apologized in print for this mistake, and at this moment I regret that it occurred.

Mr. Proctor has not accepted an apology made in good faith and he does not now accept it. I regret this also; but I do not see that there is anything more required of me in this especial matter.

Mixed in with his remarks upon this particular point, I find

various attacks upon me, personally, and upon my scientific reputation generally.

I decline to enter upon the question of my personal merits as a gentleman. This is a question to be decided by my contemporaries and not by Mr. Proctor nor by myself.

I further decline to enter into the question as to my merits as a scientific man. This, again, is a matter to be settled by my contemporaries and by those who will come after, and neither by Mr. Proctor or by myself.

I have the personal satisfaction of knowing that I have honestly striven to do my duty and that my contemporaries have been more than kind to me.

The Royal Astronomical Society which forced Mr. Proctor out of the position of its Secretary has honored me by selecting me as one of its fifty Foreign Associates.

I have held public positions of various kinds since 1870 and I have no reason to be ashamed of the results of my work at the U. S. Naval Observatory at Washington, at the Washburn Observatory at Madison, Wisconsin, and at the University of California. Some of the men with whose names Mr. Proctor says I ought not to presume to couple my own are glad to look forward to being associated with me at the Lick Observatory. I remark in passing that Mr. Proctor couples his own name, characteristically, with Sir Isaac Newton's.

Finally, looking back over the twelve years during which Mr. Procter has nursed his wrath, I have to regret that in writing my original review I made a mistake which did him an unintentional injustice and which obliges me to make this reply. I reflect, however, that reviewing his books adversely was the real offense, not accidentally mentioning one of his book titles as sensational.—*Examiner*. EDWARD S. HOLDEN.

KEPLER'S CORRESPONDENCE IN 1599.*

[Continued from page 138.]

4. How will you make the character of man depend upon his horiscope, in a point of the heavens? For it influences a

* Translated from the Latin for the MESSENGER by Professor Louisa H. Richardson, Carleton College.

man as long as he lives, just as those fetters put upon the gourds by the skill of the farmer: although they do not increase the gourd, yet they give it shape. So the constellation, although it does not give character, nor deeds, nor fortune, nor children, nor riches, nor wife to a man, nevertheless it forms all things which come to the man. And yet this, while the man lives, takes an infinite number of forms from the natal hour, never remains:—and so the natal position is lost. How can that act which does not exist? For it has an influence while it is in this position, but the position does not remain. Or is some mark of that position impressed upon the body, upon the soul, kindred to light, and suited to this thing? And how is that, which has no existence, impressed upon fortune? Experience proves all these things, and that, experience of men by no means foolish. Look at a man at whose birth the planets, Jupiter and Venus, the means between the extremes, as I said above, are not favorably situated: although such a man may be upright and wise, yet you will see that he experiences a fortune as sad and gloomy as possible. Such a woman is known to me. She is praised throughout the whole city on account of her virtue, her modesty and her chastity. Yet she is plain and of a coarse body. She was restrained with severity by her parents in her early life, and when she had scarcely attained womanhood was married against her will to a man of forty years. In a short time he died, and she married with more willing mind, another of the same age, but one who could not be called a man, and the whole four years, which she lived in this marriage, was passed in sickness. She married for the third time a poor and despised man, though she herself was rich before. Her property was wrongfully held from her on all sides. She could never have a maid but proved faithless. She became entangled and involved in all her business. She even bore children with sorrow. Everything else was of this nature. Here you may see the same mark of mind, body and fortune, analogous indeed to the position of the constellation; and so it would be

impossible that this mind was the cause of this whole fortune, since it was beyond her power and control.

Since Saturn and the sun agreed in the sexangular radiation for me (I speak more freely concerning very well known facts) my body is dry and knotty, not large, my spirits low, wholly driven into straits, suspicious, timid, coming through difficulties and embarrassments, and lingering in them, my character is very similar. It is my delight to gnaw bones, to eat dry bread, to taste the bitter and acid; it is my pleasure to walk through rough places, declivities, and thickets. I have no charms of life except letters, nor do I desire any, and when offered I scorn them. My fortune is similar in the smallest detail. Other things are dispaired of. I have an access, by no means great, to property and reputation. For I am continually hard pressed among the rising and circumstances indeed change, the form remains the same. With whatever I have striven thus far, I have been harshly opposed. I know not whether genius also is drawn into the alliance while I defend the human race for appealing to the motion of the earth, while I with resolute boldness urge on an orb of so great weight, with swift motion through the stars, while the senate of terrestrials strive in opposition. But let this indeed be ascribed to the common lot of illustrious men. Let this prevail, "hardships are blessings," etc., and this used by Cicero, "the sweat of virtue," etc. And I am not opposed to that theory of the wise, nay rather, most certain demonstration, by which they prove that truth is ever opposed by the multitude. Let there be, then, talent and zeal begun with reason, free from those things which belong to the heavens. Let the former be retained. And you see again one characteristic in me depending upon the heavens, not indeed so plainly from the sixth position of the sun and Saturn, but thus for the sake of brevity have I spoken. For those who are wont to speak thus plainly selling much material, stones and cement, for a house, would quickly have done me a wrong. For I myself was born when the sun, Venus and Mercury were in Capricorn. And so you see Wirtemberg will be at length destined for me. Let these

therefore be the examples and forms of experience. I wonder why these things are not treated by philosophers. Either because many vain things are handed down, or because rules are made (such even as you seem to demand, canons--and guides of very little use to a philosopher, who does not busy himself with every detail) rules, I say, easy and deceptive in almost the same elements, which are contradicted also by the first experience. Or are these again becoming obsolete, of themselves, on account of the difficulty of astrology, although formerly they crept into the minds of philosophers? Of such a nature also is that question concerning the magnet and countless other questions which are regarded among miracles, since they do not coincide with the axioms of physics, and it is deemed sufficient that each is known separately. But since there are so many, let some one of you who compare many things with each other, come forth and render the reasons not of one thing alone, which is impossible, but of many such, united. While I was attempting this in my office before this, two philosophical methods came to my mind, one of the type and archetype, Platonic as I think, the other of the Genii derived from letters. For the world is the corporeal image of God, the soul is the incorporeal image of God and yet created. The body is the image of the world, hence microcosmos; the forms of bodies, of souls, the diversities of fortune are the images of diversities which exist between the positions of the heavenly bodies. Thus the birth of man corresponds to the rising of a planet, the death of man and what follows corresponds to the setting. And that which is between forms the actions of man and those things which follow man in life. And inasmuch as the setting looks back to the rising with a certain relation of opposites, so also man's correlatives are shown in the seventh or setting, as wife, purchaser, physician, slave, etc. And the position of the heavenly bodies, since it is regarded in a point, has something lasting which corresponds to it in man, and this is that same character which I have mentioned of mind, body and fortune. But the motion of the heavenly bodies, which is considered with time, is an example of temporal

things in man, namely his actions, of which I shall speak later. But nevertheless because I do not yet know where that imaginary canopy is kept in the mean time, since the constellation moves on after the moment of birth, I have therefore introduced Genii. For the body is too material—for undertaking this character—but the soul, although it is kindred to light, although it has no less wonderful duties entrusted to it by God, the formation of necessary parts and other things—and thus it could well be made the subject of this character impressed by the constellation; — nevertheless I do not know, how it could, outside the man, form his fortunes according to the standard prescribed by that character given by the constellation. And so those tutelary Genii taken from the Bible are pleasing to me,—who preside over the birth of men by a certain divine law, and receive the character of the nativity in place of the men themselves, either in their own being, or in memory alone, and offer themselves to the bonds of heaven, and are not of free thought at all, but either grow weak or strong according to the movement of the constellation. We have an example of this mingling, in light, which, although it is not corporeal, but something divine, nevertheless it is subject to the laws of body without time indeed and motion: it is reflected, refracted, it is thrown on stronger, weaker, it is cut off, it is lessened by distance, etc. It is a good example in this case. For above I made the nature of the light and of souls the same, here also I make the nature of the Genii either the same or kindred.

5. Related to these is the question concerning the rise of man. I have a very pleasant sight in the relations of the natal hours. Who, then, is there who puts off birth to that time and moment that the offspring may be brought forth under a constellation favorable to the parents. This thing alone would convert even Mirandola himself (if he fights more than against trifles). Who, I say, is that director, immediate God? Is it the soul of the mother, or of the child? And how could he be skilled in astronomy when man himself is ignorant? No one ever lived so wise that, freed from the material body, he

learned anything of astronomical subjects through ecstasy. Or then does the heavenly light itself with so great reason measure out the moments of births? But can the rays of light and of the stars accomplish so much? Even to the rays of the stars so much must not be granted that, with so great intelligence, they can do a thing which it is scarcely credible any mind can do. For in the town also many obstacles would be opposed to the rays of light, and we must say here what was said above—if it is the effect of the rays, it is not then of the light, but of the position, not of the star, but of the stars. It would be absurd that the light and ray itself should become a body, as it were, which should be formed by its position or by a soul for this work, and should be instructed by the best reason. For even this relation also of children to parents exists in the radiations.

(To be continued.)

THE SECOND CENTENNIAL OF THE PRINCIPIA.

The mathematician, physicist or astronomer who thinks of 1887 as the second centennial year of the Principia will instinctively and eagerly go back, in thought, two hundred years to live over again the memorable scenes attending the publication of this first great work of the illustrious Newton. How he came to compose the Principia and the stir that it made in the world of science and letters are inspiring details of his biography that any may read, and all should know, to judge well of his genius and nobleness of character. Newton was 45 years old when this book was given to the world, although some of its great thoughts had been kept in mind patiently for more than twenty years. When he learned in 1682 of the successful measurement of an arc of the meridian by the French astronomer, M. Picard, in 1679, he took note of the result, and quickly computed therefrom the diameter of the earth, and with these new data he resumed his former calculations by which he had tried in 1666 to show the identity of the law of falling bodies at the earth's surface with that which guides the moon in her orbit. As the computation progressed and he

saw that his method was right, the amazing magnitude of his discovery began to dawn upon him, and its stupendous results overpowered him so much that he was obliged to entrust the finishing of his computation to the hand of a friend. His biographer has pictured this scene in these fitting words:

"It were difficult, nay impossible to imagine, even, the influence of a result like this upon a mind like Newton's. It was as if the key-stone had been fitted to the glorious arch by which his spirit should ascend to the outskirts of infinite space—spanning the immeasurable—weighing the imponderable—computing the incalculable—mapping out the marching of the planets, and the far-wanderings of the comets, and catching, bring back to earth some clearer notes of that higher melody which, as a sounding voice, bears perpetual witness to the design and omnipotence of a creating Deity."

Under an inspiration like this we may imagine that Newton wrote out, in bold outline, his great thought of universal gravitation, choosing for a title of the entire work the broad phrase, The Mathematical Principles of Natural Philosophy. It consisted of three books, the first two dealing with the motion of bodies, and the last titled "The System of the World," the matter of all being given in the form of mathematical propositions and proofs, with suitable drawings.

Although Newton appreciated in some degree the great work that he was doing, yet the low estimate that he placed on his own way of doing it, and the utter dislike that he had for the discussion that his new ideas and principles were constantly eliciting are well expressed in his own words, as follows:

"I had indeed composed this third book in a popular method, that it might be read by many; but afterwards considering that such as had not sufficiently entered into the principles could not easily discover the strength of the consequences, nor lay aside the prejudices to which they had been many years accustomed, therefore to prevent disputes which might be raised on such accounts, I chose to reduce the substance of this book into the form of propositions, in the mathematical way,

which should be read only by those who had first made themselves masters of the principles established in the preceding books."

Newton was without means or influence at this time, and the noble Halley who stood high in the Royal Astronomical Society befriended him, and generously assumed the cost of publishing the Principia in a better form and with more matter than Newton had intended to use.

How Dr. Hook and a host of others prominent in name, in England, either claimed precedence or share in Newton's brilliant discoveries that they were obliged to acknowledge as true, or assailed him and his friends bitterly for promulgating and supporting such ideas as the compound nature of white light, and the fact that the solar spectrum could possibly be more than three and one-half inches long, the devotees of science in the year 1887 will remember with impatience and pity while they wonder that the sensitive and pure-minded Newton could withstand all this and still triumph so royally. It is a wonder also to the best minds of this memorial year of the Principia that any one person in Newton's time could possibly have given to the world the first thoughts of the infinitesimal analysis, now the most powerful instrument of investigation known to the whole realm of mathematics and science in general. When the scholar of to-day opens the Principia and drinks in the breadth and depth and sublimity of its thought, can any such hesitate to acknowledge the divine help that guided the pen of the immortal Newton?

EDITORIAL NOTES.

The next MESSENGER will be published in September, July and August being vacation months.

Dr. H. C. Wilson of Washington, D. C., has been invited to a position in the new observatory at Carleton College, Northfield, Minn. His instruments will be the Meridian Circle and the Equatorial. As soon as his part of the reductions of the observations of the Transit of Venus is completed at Wash-

ington he is expected to assume the duties of the new position.

The fine new observatory building at Carleton College is now very nearly completed. The instruments will be remounted within the next sixty days. In our September issue we hope to give a cut of the new building with detailed description of its plan, instruments, and something of the work contemplated.

Quite soon, articles on interesting topics are expected from Professors Hall and Harkness of Washington, and S. C. Chandler, Jr. of Cambridge, Mass.

Anuario for 1887 from the national observatory at Tacubaya, Mexico, is received. It contains the usual matter, with two beautiful photographs of phases of the annular eclipse for 1886.

Elements of Comet e 1887 (Barnard).—On May 13, a telegram was received at Harvard College Observatory, announcing the discovery of a comet on the night of May 12, by Mr. E. E. Barnard, of Vanderbilt University, Nashville, Tenn. The discovery position was with reference to an 8th magnitude star, in a 15h 11m 41s, δ S. 30° 48′, the comet being north preceding 0m 58.93s in a, and 11′ 53″ in δ. The comparison star being recognized as *Cordoba General Catalogue* 20734, the following position was deduced by Mr. S. C. Chandler, Jr., and circulated as the discovery position:

1887, May 12.706515d Gr. M. T.
App. a 15h 10m 49.18s
App. δ — 30° 35′ 50.6″

A letter from Mr. Barnard states the position to be the result of nine ring-micrometer comparisons, the exact data being, in a 0m 58.96s, in δ 11′ 52.8″.

On the night of May 13, Mr. Chandler observed the comet at Cambridge, his position being distributed on the following morning to astronomers in this country. All the positions which have come to hand are here given, the Nashville posi-

tions being communicated by telegraph by Mr. Barnard, those from Albany by Prof. Boss, and the Harvard College (Wendell) positions being taken from a local newspaper.

Greenwich M. T.	R. A.			Decl.			Observer.
d	h	m	s	°	′	″	
May 12.70651	15	10	49.18	−30	35	50.6	Barnard.
13.63591	15	12	16.3	−30	7	26	Wendell.
13.65590	15	12	19.79	−30	6	32	Chandler.
13.67772	15	12	21.33	−30	6	4.4	Barnard.
13.67994	15	12	20.42	−30	6	1.3	Boss.
14.64053	15	13	53.6	−29	35	20	Wendell.
15.71349	15	15	38.41	−28	59	44.7	Boss.

In *Science Observer* and the *Astronomical Journal*, each of May 18, are found the following elements and ephemeris of Comet *e* 1887:

$$T = 1887 \text{ June } 26.682 \text{ G. M. T.}$$

$$\left.\begin{aligned} \omega &= 27^\circ\ 42.6' \\ \Omega &= 244\ \ 41.4 \\ i &= 17\ \ \ 2.4 \end{aligned}\right\}\text{App. Equinox.}$$

$$\log q = 0.10216$$

Comparison with middle place gives $C - O$:

$$\Delta\lambda \cos\beta = -0.06'$$
$$\Delta\beta = -0.24$$

The following is the ephemeris for Greenwich midnight:

1887	α			δ		log Δ	light
	h	m	s	°	′		
June 3.5	15	57	4	−13	21	9.4869	2.4
" 7.5	16	8	32	8	54	9.4714	2.6
" 11.5		20	48	−4	17	9.4618	2.7
" 15.5		33	44	+0	21	9.4586	2.8
" 19.5	16	47	4	+4	47	9.4614	2.9

The light of May 12 is taken as unity.

Finlay's Comet.—I think Mr. Wilson's interesting article in your April number renders it highly improbable that the comets of Di Vico and Finlay are identical. There seems however to be a more probable case of identity between Finlay's comet

and the comet of 1585, the resemblance of whose elements to that of Di Vico has been already noticed. For comparison I give the leading elements of the three, but those of the comet of 1585 having been computed for a parabolic orbit will no doubt require modification:

	π		Ω		i		q
Comet of 1585	9°	8′	37°	44′	6°	5′	1.0948
Di Vico's Comet	343	6	64	24	2	55	1.1864
Finlay's Comet	7	33	52	26	3	2	0.9978

If the first and third of these comets are identical and the number of revolutions is 45 the mean period would be 6.69 years. This agrees sufficiently closely with the period of 6.675 years assigned to Finlay's Comet.

It seems past doubt however that in many instances there are families of comets. This fact renders the identification of individual comets somewhat precarious. But these three comets plainly belong to the same family. W. H. S. MONCK.

Dublin, Ireland, May, 1887.

Under date of May 2, Mr. Barnard kindly sent to the MESSENGER the following, designed for the May number, which was received too late for publication:

Orbit of Comet d 1887 (Barnard Feb. 16).—From my own observations of Feb. 16th–28th and March 12th I have come puted the following orbit of Comet *d*. The observations were first corrected for parallax and aberration by an approximat- orbit (SID. MESS. for April).

ELEMENTS.

$$T = 1887 \text{ March } 28.39633 \text{ G. M. T.}$$

$$\left.\begin{aligned} \omega &= 36^\circ\ 28'\ 50'' \\ \Omega &= 135\ \ 27\ \ 17 \\ i &= 139\ \ 48\ \ 39 \end{aligned}\right\} \text{Mean Eq. } 1887.0$$

$$\log q = 0.00295$$

E. E. BARNARD.

Vanderbilt University Observatory, Nashville, Tenn.

Photographic Study of Stellar Spectra.—The first annual report of the photographic study of stellar spectra, conducted

at the Harvard College Observatory, through the patronage of the Henry Draper Memorial, has just appeared.

The report begins by citing the facts that Dr. Draper was the first to photograph the lines of a stellar spectrum and relating how he pursued the work with skill and characteristic ingenuity until interrupted by his death in 1882; and how Mrs. Draper has made liberal provision for carrying forward the work at Harvard College Observatory, on a larger scale, by the aid of the improved dry-plate process and other modern facilities incident to the rapid growth of stellar photography. The instruments used are an 8-inch Voigtländer photographic lens, Dr. Draper's 11-inch photographic lens, the 15-inch refractor, Dr. Draper's 28-inch reflector (soon to be added) and a 15-inch mirror constructed by Dr. Draper with which his photograph of the moon was taken.

A brief description of the experimental work with the instruments, the stars tried, and plates showing the results obtained make a prominent part of the paper.

The investigations to be pursued in this department of the observatory work are,

1. A catalogue of spectra of bright stars.
2. A catalogue of spectra of faint stars.
3. A detailed study of the spectra of the brighter stars.
4. Faint stellar spectra.
5. Absorption spectra.
6. Wave lengths.

It is thought that this photographic apparatus will be sufficiently delicate to determine the motions of the stars with a high degree of precision; as it is claimed an outfit has been furnished, on a scale unequaled elsewhere, and that Mrs. Draper has provided means for continued observation, reduction and publication suited to the capacity of the instruments. This being true the Draper Memorial is a noble monument to the useful memory of one of America's noblest sons of Science. May it endure untarnished. But the Director of the H. C. Observatory disappoints his friends when he speaks weak words concerning the encouragement of small observatories.

New Method for Time and Azimuth.—The method perfected by Professor Wm. Döllen and widely used by Russian geodesists, according to which time and azimuth are determined, in a few minutes at any time of day, by setting the portable transit instrument, a universal instrument, in the vertical of the pole star, is one that is perhaps not so well known to American astronomers as it deserves to be. It is peculiarly adapted to the needs of explorers and those who have to do their observing by daylight. For the great convenience of the increasing number of those who are learning to use Döllen's method, he has published "Stern Ephemeriden auf das Jahr 1887, zur Bestimmung von Zeit und Azimut mittelst des tragbaren Durchgangsinstruments im verticale des Polarsterns." Copies of this ephemeris can be had (by any who will study or teach or practice this method) by application to Professor Cleveland Abbe, Washington, D. C. We are obliged to Professor Abbe for kindly calling our attention to this interesting matter.

New Red Star near 26 Cygni.—T. E. Espin, observer to the Liverpool Astronomical Society, discovered March 23 and 27 a new red star 7.5 magnitude, 0*h* 0*m* 5*s* F. 0° 3′ S 26 Cygni. Its spectrum III !!!.

Characteristic Curves of Composition.—The applications of the mathematics seem to be unlimited, and Professor Mendenhall is out with a late genuine surprise in this direction, as neat in principle as it may prove useful in practice. In a paper of 14 pages he gives a plan for analyzing composition on representative counts of words used by a writer, in regard to length and relative frequency. When these counts have been made for any composition, the resulting numbers are placed in order on the adjacent sides of paper ruled in squares like mathematical or computing paper, and a curve is drawn on the paper as directed by the numbers. Several interesting graphic illustrations are given in the paper before us and the tests of the system are surprisingly satisfactory. What need longer for Mr. Donnelly to be in doubt whether Bacon is the author of Shakespeare or not. A school boy who will take the time to count

words enough of Bacon's writings and arrange the resulting numbers in proper form will doubtless find a satisfactory answer to the great question.

The Origin of Nebulæ.—We have not before had the privilege of reading Dr. James Croll's *Origin of the Nebulæ*, an article which was published in the *Philosophical Magazine* for July, 1878, a copy of which this distinguished author has recently kindly furnished us. Parts of it, if not all, will appear later as space may be given to this important theme.

Sur Les Spectres Invisibles is a translation of Professor Langley's publication into the French by Charles Baye, and published by Ganthier Villars of Paris. It is an honorable notice of American work.

The American Astronomical Society of Brooklyn, N. Y., has published papers read before it during the last two years in neat pamphlet form, consisting, thus far, of 55 pages in two numbers. These papers are excellent and deserve a fuller notice than space at this time will allow. The writers are, most of them, practical observers or workers who already have reputation in astronomical circles, as, for example, Professor Geo. W. Coakley, Henry M. Parkhurst, Garrett P. Serviss, and others that should be named. That society seems to be doing good work and should prosper.

Warner Prizes for 1887.—From April 1st, 1887, to April 1st, 1888, I offer ($100) one hundred dollars for each and every discovery of a new comet made between the above dates, subject to the following three conditions:

1. It may be discovered either by the naked eye or telescope, but it must be unexpected, except as to the comet of 1815, which is now looked for.

2. (a) The discoverer, if residing in the United States or Canada, must send a *prepaid telegram immediately* to Dr. Lewis Swift, Director, Warner Observatory, Rochester, N. Y., giving the time of discovery, the position and direction of mo-

tion with sufficient exactness, if possible, to enable at least one other observer to find it. (b) Discoverers in the other countries must send *by immediate mail* a full account of the discovery, as above required, to Dr. Lewis Swift, as above.

3. In the United States and Canada this intelligence must *not be communicated to any other party or parties*, either by letter, telegraph or otherwise until publicly announced through the press by Dr. Swift, which he will do at once on information of the discovery. Great care should be observed regarding this condition, as it is essential to prevent duplication of announcements and for the correct transmission of the discovery, with the name of the discoverer, which will be immediately made by Dr. Swift.

Discoverers living in *Continental Europe*, will receive their prizes from Warner's Safe Cure Establishment, 10 Schæffergasse, Frankfurt on the Main, Germany; those living in *Great Britain*, from H. H. Warner & Co's Safe Remedies office, 47 Farringdon St., E. C., London; those in Australasia and Asia, from H. H. Warner & Co's Safe Cure Branch House, 147 Little Lonsdale St. W., Melbourne, Australia; for other parts of the world, prizes will be paid here.

Prizes will be awarded four (4) months after discovery and verification of claim.

Three disinterested scientists will be selected to settle any dispute that may arise regarding comet discoveries.

ROCHESTER, N. Y., March 15, 1887. H. H. WARNER.

The Great Southern Comet.—Unusual interest was felt in astronomical circles concerning the appearance of comet *a* of 1887, which was also called the Great Southern Comet. It was first seen by Thome of Cordoba, South America, June 18, and soon after telegraphed to astronomers generally. This comet was without head or nucleus so that observations for place were very uncertain always, and worth very little for determining an orbit. It was observed through the month of January while passing through the constellations of Phœnix and Eridinus, and from the 22nd to the 25th the long, slim

train extending to a length of 40° was a beautiful sight to the naked eye. Dr. Thome computed the elements of its orbit finding that the comet had passed its perihelion Jan. 8, at a distance of about 18,000,000 miles from the sun with motion retrograde. In A. J. 156 S. C. Chandler has given a very full and thorough study of this comet, having computed a second orbit with the following elements:

$$T = 1887, \text{ Jan. } 8.730$$
$$\omega = 174^\circ\ 48.6'$$
$$\Omega = 132\ \ 48.6$$
$$i = 57\ \ 52.1$$
$$\log q = 8.36280$$
$$C - O$$
$$\Delta\lambda \cos\beta\ .\ -1.2'$$
$$\Delta\beta\ \ +2.3$$

From recent foreign papers we notice that the computation of final orbits for the following comets has been undertaken by the persons named below:

Winecke's Comet by Baron E. von Härdtl.
Comet 1840 I by Mr. Rechenberg.
Comet 1848 I by Mr. F. Bidschof.
Comet 1865 I by Mr. F. Koerber.
Comet 1879 V by Prof. T. Zona.
Comet 1882 II by Mr. H. Kreutz.
Comet 1882 III by Mr. L. Stutz.
Comet 1885 III by Prof. J. Gallenmüller.
Comet 1886 III by Prof. G. Celoria.
Comet 1886 IV by Dr. S. Oppenheim and Mr. F. Bidschof.

Paris Astronomical Congress.—This gathering of distinguished astronomers and physicists was in session at the large hall of the Paris Observatory from April 16 to April 25. The following persons were present: Auwers, Berlin; Baillaud, Toulouse; Bakhuyzen, Leyden; Bertrand, Paris; Beuf, La Plato; Bouquet de la Grye, Paris; Brunner, Paris; Christie, Greenwich; Cloué, Paris; Common, Ealing; Cornu, Paris; Cruls, Brazil; Donner, Helsingfors; Dunér, Lund; Eder, Vi-

enna; Elkin, America; Faye, Paris; Fizeau, Paris; Folie, Brussels; Gautier, Geneva; Gill, Cape of Good Hope; Gyldén, Stockholm; Hasselberg, Pulkowa; Henry (Brother), Paris; Janssen, Meudon; Kapteyn, Gröningen; Knobel, London; Krueger, Kiel; Laussedat, Paris; Liard, Paris; Loewy, Paris; Lohse, Potsdam; Mouchez, Paris; Oom, Lisbon; Oudemans, Utrecht; Pechüle, Copenhagen; Perrier, Paris; Perry, Stronghurst; Peters, Clinton; Pujazon, Cadiz; Payet, Bordeaux; Roberts, Liverpool; Russel, Sydney; Schönfeld, Bonn; Steinheil, Munich; Struve, Pulkowa; Tachini, Rome; Tennant, Ealing; Thiele, Copenhagen; Tisserand, Paris; Trepied, Algiers; Vogel, Potsdam; Weiss, Vienna; Winterhabter, Washington; Wolf, Paris.

Regarding instruments to be used in celestial photography, this conference decide,

(1.) The instruments employed shall be exclusively refractors, and may be made locally provided the conditions laid down by the conference be fulfilled.

(2.) The stars shall be photographed as far as the fourteenth magnitude inclusively, this magnitude being indicated provisionally by the scale actually in use in France, and with the reservation that the photographic value shall be definitely fixed afterward.

(3.) The aperture of the object-glasses shall be 0.33 meter, and the focal length about 3.43 meters, so that a minute of arc shall be represented approximately by 0.001 meter.

Concerning photographic plates it was decided:

(1.) All plates to be used should be prepared according to an identical formula to be subsequently determined.

(2.) A permanent control of these plates from a point of view of their relative sensibility of the different radiations shall be instituted.

(3.) The aplanatism and achromatism of the object-glasses employed shall be calculated for the wave lengths near Fraunhofer's G.

The account given in *Nature*, No. 1, Vol. 6, of the discussions of these and many other kindred points is instructive reading.

Haynald Observatorium.—The publications of this observatory at Kaloosa, in three parts for 1886, have been received. The work is under the direction of Hüninger, Adolf S. J., and the illustiations of solar protuberances for 1884–1886 are instructive.

Astronomical Photography.—The Princeton *Review* for May has a full and delightful article on the theme of astronomical photography by Professor Young. He first glances at the history of this new branch of astronomical work, then notices the comparative merits of refracting and reflecting telescopes, after which follows a particular and classified statement of work now going on:

(1) Photographs of the solar surface, (2) photographs of the corona, (3) of the solar prominences, (4) of the moon, (5) planetary photography, (6) photography of comets and (7) of nebulæ. Under the head of the use of photography as a means of *precision* in astronomical work, he speaks of photographs of eclipses, the transit of Venus, star-charts, double-stars, star-groups and clusters, and stellar parallax, of meridian observations, of photometry and of stellar spectra. In point of historical development, range of efficiency and judicious statement of astronomical facts, this article is very valuable for reference.

Brass Micrometer Screws.—M. D. Ewell, of Chicago, noticing the irregularities in the work of his micrometer, which had the appearance of coming from the heat of the hand on the brass milled head screws of the instrument, has recently had them all removed and replaced by the material of hard rubber. In a late private note he says he now has no further trouble.

Intra Mercurial Investigations.—The total eclipse of the sun which will occur near our midnight of Aug. 18 next may prove to be one of the most important of those witnessed in this century. The path of totality will pass across Europe and Asia, giving an opportunity for observations from scores of easily accessible stations. The greatest duration will be only three and eight-tenths minutes, but wonders may be accom-

plished in, that short interval between the disappearance and reappearance of the sun. The United States will be well represented by a party in Japan, which will take especial pains to photograph the corona and surrounding sky. It is understood that Old World observers will also work largely on the same general plan.

It now looks as if the question of existence or non-existence of an intra-mercurial planet will come to the front on this occasion, after having been quietly shelved for several years.—*Chicago Tribune.*

The Holden-Proctor Correspondence.—We gladly give place to the reply of President Holden to Professor Proctor, whose letter was mentioned in the May MESSENGER. The dignity and courtesy of the answer in general is a credit to President Holden and the prominent position he occupies.

Orientation of Photographic Plates.—The late conference of astronomers, at Paris, passed the following resolutions in regard to the orientation of photographic negatives for star catalogues:

Besides the negatives giving the stars down to the fourteenth magnitude, another series should be made with shorter exposures, to assure a greater precision in the micrometrical measurement of the fundamental stars, and render possible the construction of a catalogue.

The supplementary negatives destined for the construction of the catalogue shall contain all the stars down to the eleventh magnitude inclusive. The Executive Committee shall determine the steps to be taken to insure that this condition is fulfilled.

The photographic plates to be used in formation of the catalogue shall be accompanied by all the data necessary to obtain the orientation and the value of its scale; and as far as possible these data shall be written on the plate itself.

Each plate of this kind shall show a well centered copy of a system of cross-wires to insure the determination of errors of the field, and to eliminate those which may be produced by a subsequent deformation of the photographic film.—*Nature.*

Variable Stars for June.—The following are the days on which the maxima of the variable stars named below occur as given by the *Astronomischen Gesellschaft*, except in the case of the fourth star which is at minimum:

June 2, T Hydræ	June 17, S Persei
5, T Delphini	18, R Delphini
5, Vulpeculæ	19, R Virginis
7, W Scorpii	22, R Geminorum
9, R Hydræ, *Min.*	23, R Orionis
14, U Virginis	23, R Capricorni
	23, T Acquarii

New Minor Planet (266) was discovered by Palisa of Vienna. In G. M. T. its place, May 17.5, was,

$$a = 16h\ 13m\ 12s$$
$$\delta = -19^\circ\ 8'$$

Planets for June.—June 5, *Mercury* sets 8*h* 45.7*m* in the evening. June 30 the planet is in greatest eastern elongation, 25° 51', good position for observation.

Venus sets June 5 at 10*h* 45.2*m*.

Mars is too near the sun for observation.

Jupiter sets June 6 at 2*h* 12*m* A. M., and is stationary on the 22nd of the month.

Saturn was in conjunction with *Venus* May 30. Its distance is now so great that observation is unfavorable.

Uranus sets June 6 at 1*h* 29*m* A. M., is stationary on the 16th, and in quadriture with the sun June 20th.

Neptune is near the sun.

BOOK NOTICES.

Elementary Treatise on Determinants by William G. Peck, Ph. D., LL. D., Professor of Mathematics and Astronomy in Columbia College. Publishers, A. S. Barnes & Co., 1887; pp. 47.

The subject of Determinants has recently proved so valuable in the study of modern coördinate Geometry and kindred branches that there is a growing demand for a knowledge of

the elementary principles of the subject, at least, either for those who teach, or those who wish to pursue modern methods of mathematical investigation. This little book treats of the elementary principles of the subject in the usual way through the definitions, principles and the properties of Determinants, minors, co-factors and reduction, and then follows the application to the solution of equations, consistence of equations, eliminants and homogeneous equations of the first degree. Following this the principles of Determinants are more fully developed and their operation on higher and unequal orders studied when the student is asked to apply to them the principles of the infinitesimal analysis which, though brief, forms an interesting feature of the work. Every teacher or live student of mathematics who has not already a good work on this theme may profitably examine this one.

Electricity and its Discoverers, by Rev. M. S. Brennan, of St. Louis. New York: D. Appleton & Co., publishers, 1885; pp. 191.

The recent extraordinary progress of knowledge in the different branches of Electricity and the possibilities of its extended uses in the practical affairs of life have turned the attention of all classes to it during the last few years. Many large and excellent books have been written, showing complex and intricate phases of theory belonging to the science for the benefit of the scholar and the specialist; but this little book has aimed only to give a knowledge of its principles to the exclusion of the mechanics of the subject. The author believes in the identity of all forms of electricity, and has depended on this relation in his treatment of it. He also speaks of it as woman's science, and gives credit to scholars of that class for original work in its development. Though not new, as a little book for the popular reader it may find a useful place in many libraries.